
Development Strategy of EV Program in China

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ABSTRACT

This paper briefly introduces the necessity of developing EV program in China, summarizes the history of EV development and analyzes its market potential. Furthermore, the authors describe the strategic plan of EV program in the ninth-five years plan as well as its newly development. Finally the paper tells the framework and principles of Chinese government to carry out the program in the near term and at the beginning of next century.

KEYWORDS: EV, Development Strategy, Organization and Management

1. Introduction

The invention and commercialization of the motor vehicles have brought about an extensive long-term influence on social economic development of humankind. In many developed countries automotive industry plays an important role as pillar industry, which drives the development of many other economic sections.

Since founding of new China, automotive industry has been a history of nearly 50 years, up to now, the registered automotive **are** more than 15 million in China. With sustainable economic boom and growth of personal income, more and more private cars would **appear** in China. It could be predicted that the private car would keep a stable growing trend in the future. Considering more than 1.2 billion population of China, the private cars will create a large market for automotive industry. Just for this reason, Chinese government has determined to develop the automotive industry to be a pillar industry for national economy. With the development of automotive industry and increase of the registered vehicles, the associated environment pollution and petroleum consumption have become serious problems day and day, disturbing sustainable development, especially in large cities.

1.1 Vehicle emission has become one of the major pollution sources in large cities.

Due to no strict emission regulation and monitoring system, the emission and noise of the existed vehicles have been the major pollution in large cities. In general case about 60% of the pollutant sources from vehicle emission in Beijing, 75% of CO, 92% of HC and 39% of NO_x in downtown area of Shanghai. The pollutant contribution ratio from vehicle section continuously rises from 1988 to 1994 in Guangzhou City: such as 64% to 99.3% for NO_x and 63% to 88.8% for CO.

Since Chinese large cities have dense population, and the operation of vehicles concentrates within the large cities also, as well as the traffic congestion are frequently to make the situation more serious, so even though the vehicle emission could reach advanced standard, its polluting effect might be worse than that of the developed countries.

With the improvement of living standards, the public pays much attention to the quality of their living environment. At the same time, environment issues and social welfare would become “hot spots” of Chinese legislation, the claims from various cycles of the society would be pressure and incentive for solving the problem of vehicle emission.

1.2 Petroleum consumption is another critical factor that should be considered for the development of Chinese auto industry.

The basic feature of Chinese energy reserve is that China is abundant in coal and less oil. Since 1994, China has been a net import country of oil resource, and more than 30 million tons of crude oil was imported in 1998, 50 million tons is predicted in 2000. The shortage of petroleum reserve would threaten the sustainable development of automotive industry in the long term. As the fundamental framework, diverse energy supply requires multiple kinds of vehicle with alternate types of fuel consumption, this is a realistic choice that China has to be faced.

In general, Chinese automotive industry will inevitably enter a new stage of fast development, at the same time, energy and environmental issues must be taken into consideration, which requires automotive industry to realize sustainable development. During its developing process, the R&D and utilization of EV is an important context for Chinese automotive industry.

2. History of EV Development in China

For the features of EV in energy and environmental aspects, its R&D activities have several decades history in China. Especially in the eighth-five years plan, EV has got some important achievements. During this period, the central government supported enterprises to carry out the development of EV and its key components. The State Science and Technology Committee, State Planning Committee and Ministry of Mechanics jointly organized powerful enterprises, research institutions and universities to develop batteries and its management system, electric motors and their control system and charging system. Meanwhile the government encouraged the trial of EV conversion including different types of vehicle.

During the ninth-five years plan, the state government has paid more attention to the development of EV. The Ministry of Science and Technology has regarded EV program as the State Major S&T Engineering Programme, and started four sub-projects: key EV technology study, development of concept car, trial of conversion vehicle and construction and operation of EV Field Test and Demonstration Zone. Otherwise, the government also organized the makeup of national

standards and incentive policies concerned. All these will make a firm foundation for the further development of Chinese EV in 21 century.

3. Market Potential of EV in China

Electric Vehicles have a broad perspective in China. With the development of EV technologies, especially the progress of battery performance, EVs can be used as urban public buses, taxi, government buses, and special vehicles. In China, the total amount of all the above vehicles is more than 2.5 million, which will form a great market. Meanwhile, considering the structure of China transportation, commuting habit out and other factors, it is easier to develop EV in China than in developed countries. If offering necessary financial supports, service, incentive policies, it is possible to develop EVs fast in some large cities as the first step. In order to realize this objective, we should organize national experts to improve the performance of electric motors, controllers, batteries, charge system and other key technologies, and try to reduce EV cost, optimize EV design, and extend EV range. While extending life cycle of current battery, we will develop new advanced battery and reduce its cost in order to lower the whole cost of EV and improve the competition capability of EV. According to the situation in China, with the support of government policies and experiment of try-out field, the ground infrastructure and service system will be gradually completed to impel the development of EV.

4. Strategic Plan of Developing Electric Vehicles in China

Developing EV is one of the objective requirements of the sustainable development strategy of automotive industry in 21st century, and also is one practical way to develop our automotive industry according to the policies of environment protection and energy. The research and development of EV will be fit for environment protection, efficient utilization of energy. Electric vehicle will also be equipped with electrical technology and ITS technology in order to achieve the strategic objectives of new transportation tools, such as cleanness, safety, comfort and convenience.

The strategic plan of developing electric vehicles in China includes the following items:

- Combining the situation in China, develop economic cars positively to meet the current and future demand of the China vehicle market.
- Starting from auto body design, develop advanced concept electric cars used in 21st century.
- Combining market demand, convert some kinds of busses including big and middle types, which will be served for urban public transportation. And building necessary ground infrastructure, improve the systems of service and maintenance.
- Convert special vehicles; extend their uses in towing, cargo transportation, warehouse, sightseeing and recreation area, bus station, dock, airport and so on;

5. New Achievements and Short-Run Plan of Chinese EV Programme

Since 1996, as national major S&T engineering programme, Chinese EV program has gained a rapid development. Up to now, several key technological studies have got important results, such as electrical motor and its controller study program undertaken by Chinese Science Academy, and electricity measure and battery management system research by Tsinghua University. For the sub-program of concept car programme, Chinese Dongfeng Motors Corporation has completed the total design of pioneer car which is a foundation for concept car, its critical parts are being tested, some other parts needed from abroad have ordered already. Cooperated with Italian company, the body

design of concept car has also started by Dongfeng Motors Corporation since Feb, 1999. Concerning sub-program of demonstration area, organized by Guangdong S&T committee, the construction of infrastructure has been finished. 17 electrical vehicles from U.S.A, Japan and China have operated more than one year. Some of them will be put into commercial operation as taxi, the test under various conditions will be further made. For the conversion sub-programme, the electrical van and electrical middle-size bus has jointly converted by universities and **auto company**, its technical performance has reached the requirements of national programme. For the last sub-program of policy and national standard, 18 standards of EV and its motor & controller, are being made which will be completed by the first half of next year.

As the short-run plan, the development of pioneer car will be finished by the end of this year, after a period of test and operation, a concept car will be made in the middle of next year which is equipped with key technologies studied by China. As the second step, 4 concept cars will be made in the middle of 2001 with three different kinds of electrical drive systems, including AC induction, DC permanent magnet brushless, and switching reluctant, meanwhile the development of NiMH, Li-Ion, Zn-Air batteries and fuel cell project are being taken. The demonstration zone will be improved further in the following two years, and by the end of this century, it could help us to learn a lot of practical experience in EV operation. The other content of the state program will also be completed by the end of next year. As the next step, the feasibility study of hybrid electric vehicle is being undertaken, and some initial prototypes are to be shown in EVS-16 exhibition. The prototype minivan powered by fuel cell is planned to be completed by the end of next year also. It could be predicted that after five years efforts, Chinese EV program could get obvious achievements and prepare a foundation for its greater development in 21th century.

6. The Model of Organization and Development for Electric Vehicles in China

The development of EV is a program of social system engineering, which has great social benefit but less economic benefit in short term. At the beginning of research, development and experiment, government plays an important role. At the same time, relevant enterprises are required to take part in positively and the role of market should be paid much attention. So whether to construct a scientific model of organization and development successfully is vital to the implementation of Chinese EV program.

- The central government is in charge for Macroscopical organization, coordination and guidance, and give necessary support in capital and policies.
- Enterprise is the main body in this program. Under the direction of market, they should choose the proper types and performance for the development of EV programme.
- Local governments should play a positive role in organization, coordination and demonstration, and is responsible for the constructions of ground infrastructure and service systems.
- Relevant departments of government organize to deal with key technical problems, which include battery, motor and its controller, intelligent charger, battery management, and so on.
- Develop international cooperation and exchange. According to the situation in China, cooperate with foreign governments and some big foreign companies to develop some key parts and integrated technologies of EV.
- Build an integrated guarantee system for development of EV mainly by taking different

measures and through different ways.

Conclusion

With the implementation of sustainable development strategy in China and under the impulse by the development of science and technology, the development of Electric Vehicles is becoming one of the most important parts of our automotive industry's development. Considering the future development of Chinese automotive industry after becoming a member of WTO, Chinese government will still take EV program as a focus in the next five-year plan. At the same time, based on the feasibility study and program design, the R&D and development of HEV will also start at the beginning of next century, which is another focus for S&T development of 21 century in the field of automotives. We can see, with the firm support of our government, the pull of market, participation of enterprises and the continuous effort of scientists and technicians, the development of Electric Vehicles will show a broad perspective in China.